



# Status and Plans for Finalization of SRT's Contribution to AIRS Version-7 and Version-7 AO

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# Background

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- A previous AIRS operational Version at JPL was Version-6.28, which was presented at the March 2016 AIRS Science Team Meeting.
- Version-6.28 performed much better than Version-6 especially with regard to water vapor profiles and total precipitable water.
- We call our current SRT system Version-6.46. Version-6.46 is significantly better than Version-6.28 for  $T(p)$ ,  $q(p)$ ,  $O_3(p)$ . Version-6.46 AO performs about as well as Version-6.46.
- SRT Version-6.46 is now installed at JPL and is called Version-6.4.6. Version-6.4.6 AIRS/AMSU and Version-6.4.6 AIRS Only (AO) have been run at JPL for January 2015 and July 2015.
- A scientifically equivalent Version-6.46 CrIS/ATMS retrieval system is now installed at the Sounder SIPS. Monthly retrievals have not been run yet.

# Success Criteria

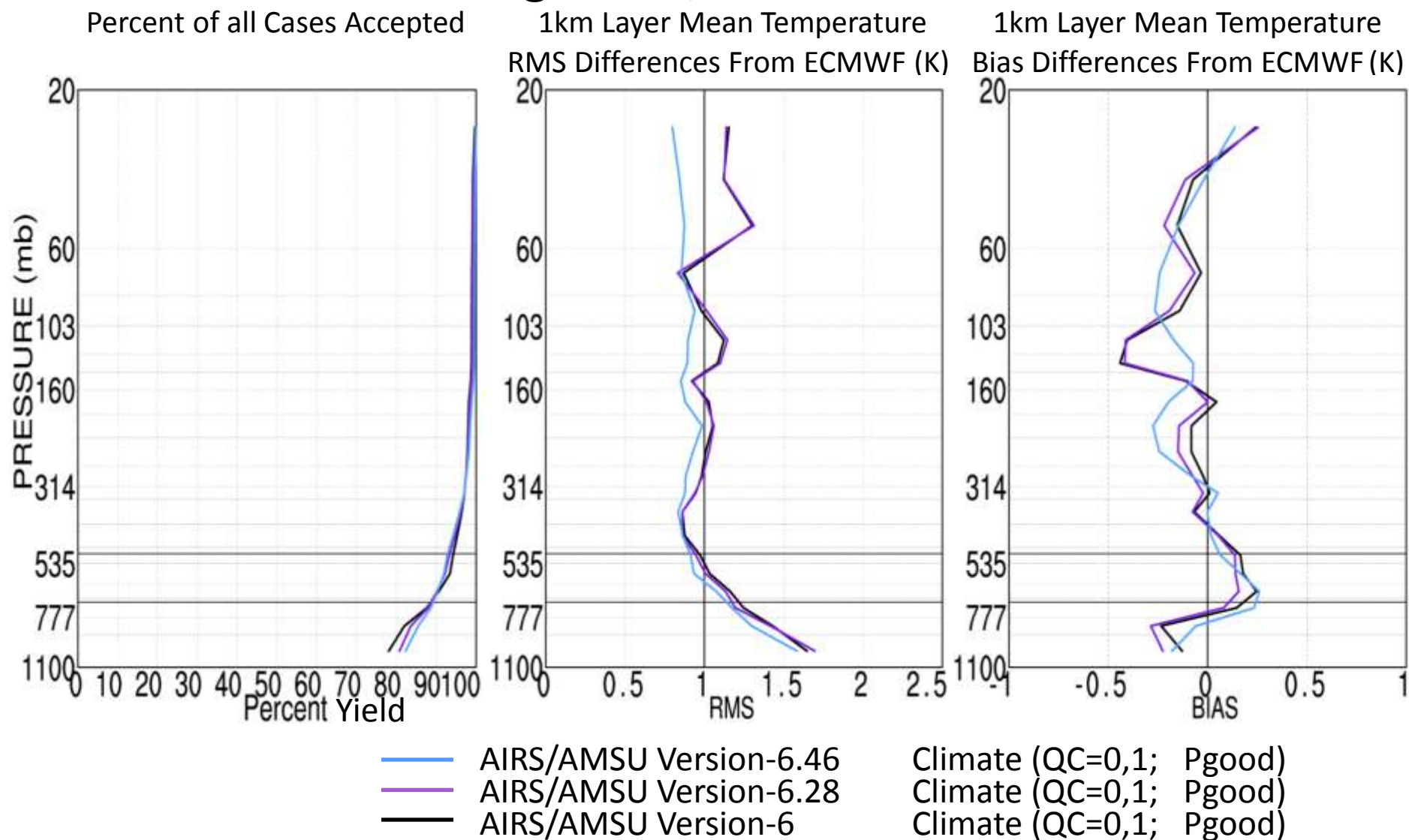
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The SRT objective is to generate accurate AIRS and CrIS monthly mean level-3 climate data sets.

- AIRS Version-7 and Version-7 AO monthly mean level-3 products, and their interannual differences, should be more accurate than AIRS Version-6.28 or AIRS Version-6.
- AIRS Version-7 AO products should at worst be only slightly poorer than those of AIRS Version-7.
- CrIS/ATMS monthly mean products, and especially their interannual differences, should match those of AIRS Version-7, and Version-7 AO, as best as possible.

We will address each of these in turn.

# August 15, 2013 Global



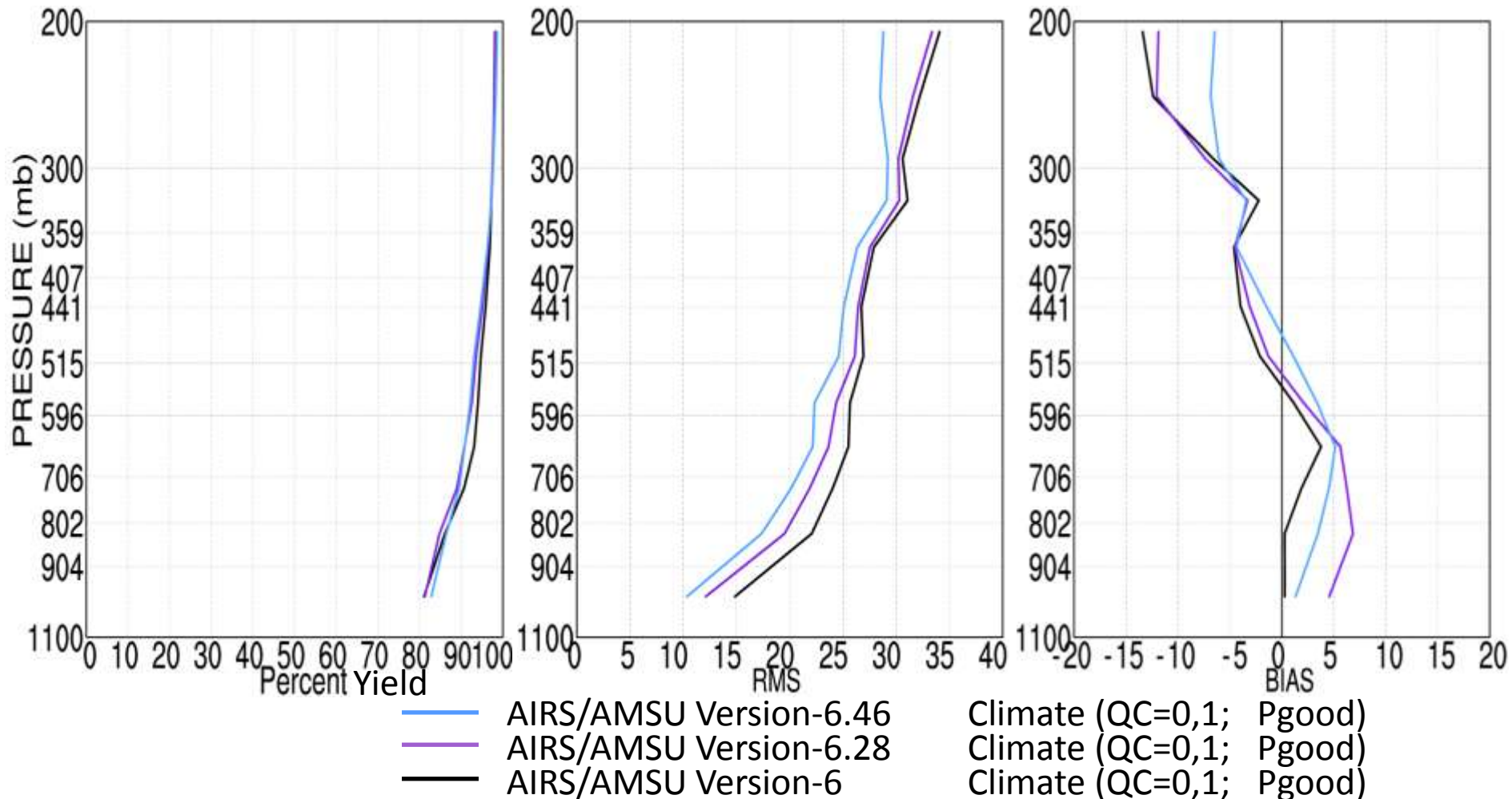
Version-6.46  $T(p)$  products passing climate QC are significantly more accurate than those of Version-6.28 or Version-6, with higher yields.

# August 15, 2013 Global

Percent of all Cases Accepted

1km Layer Precipitable Water  
RMS % Differences From ECMWF

1km Layer Precipitable Water  
Bias % Differences From ECMWF



AIRS Version-6.46 water vapor profiles are significantly more accurate than those of Version-6.28 or Version-6. AIRS Version-6.46 water vapor profiles are biased dry in the upper troposphere, but by a lesser amount than previous Versions.

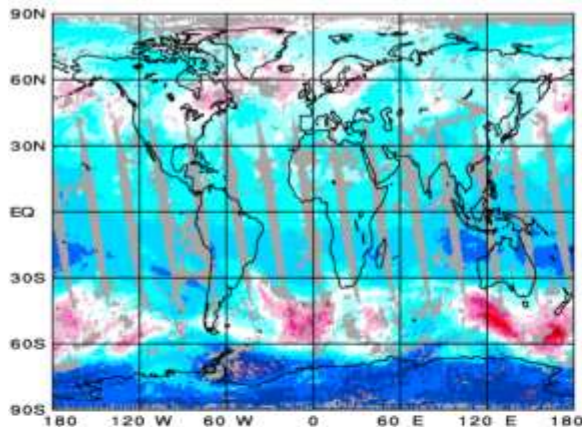


Ozone (DU)  
August 15, 2013 1:30 PM

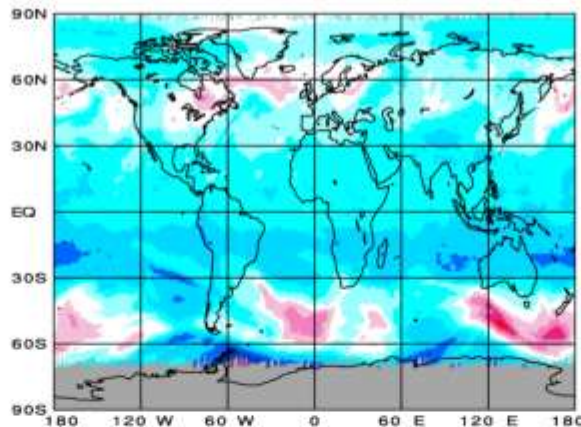
AIRS/AMSU Version-6.46

OMPS

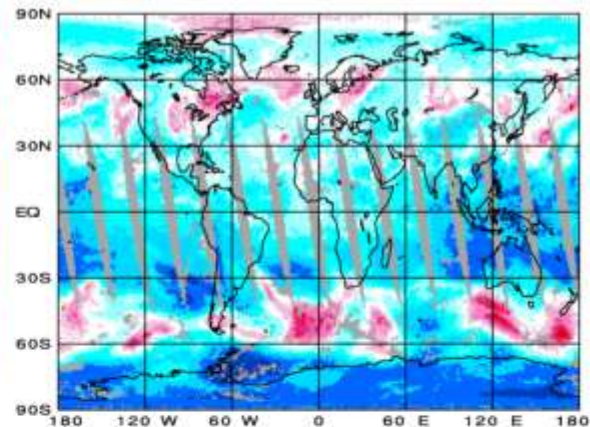
AIRS/AMSU Version-6



GM=294.60 STD=33.01 %Fill 76.18

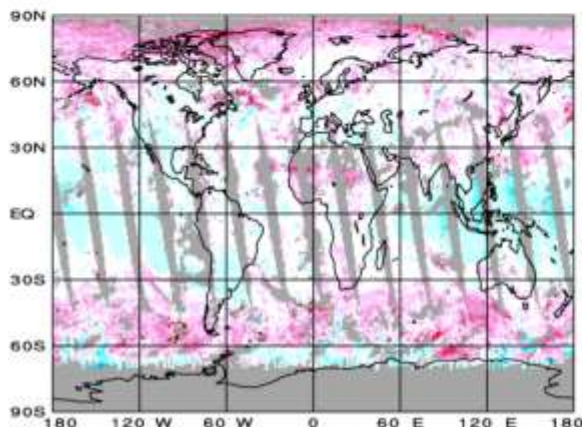


GM=293.06 STD=26.93 %Fill 87.35



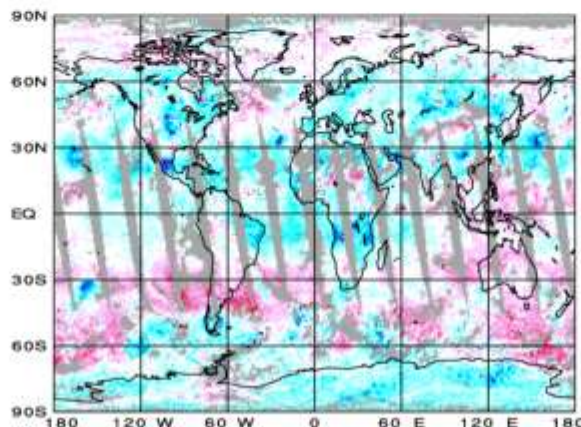
GM=299.65 STD=37.41 %Fill 85.10

V6.46 minus OMPS



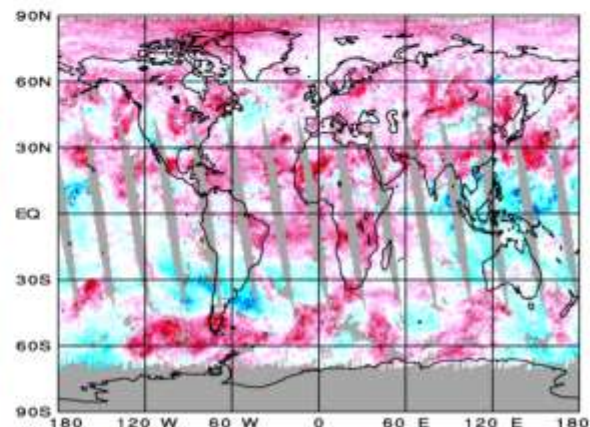
GM= 1.22 STD= 9.84 Corr= 0.95

V6.46 minus V6



GM= -5.45 STD=15.25 Corr= 0.94

V6 minus OMPS



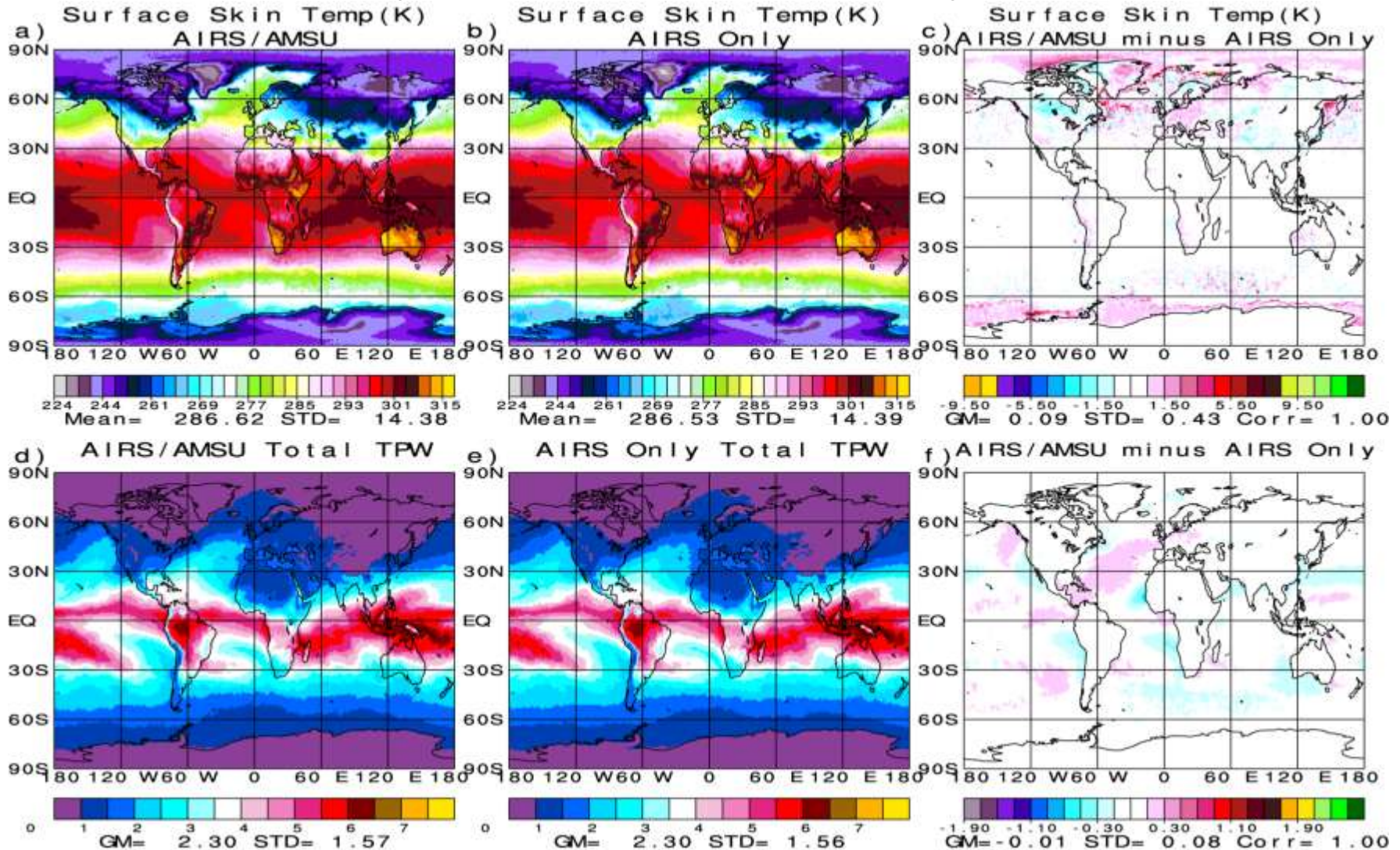
GM= 6.00 STD=18.15 Corr= 0.89

AIRS Version-6.46 total  $O_3$  is in excellent agreement with OMPS and is much better than Version-6 total  $O_3$ . Note also that the ozone hole over Antarctica is much deeper in Version-6.46 than it was in Version-6. AIRS Version-6.46 total  $O_3$  is also better than Version-6. 28.

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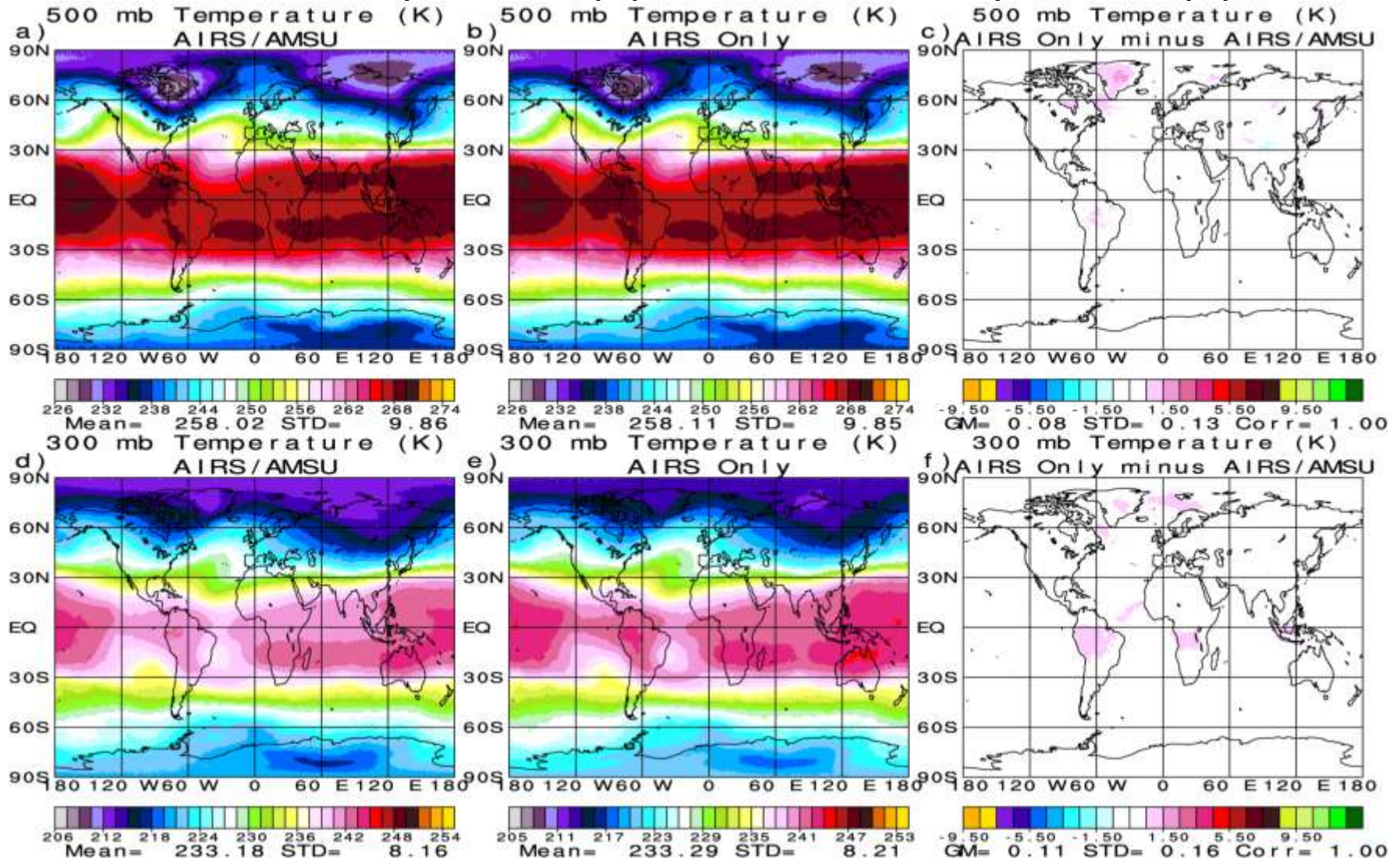
# January 2015 Version-6.4.6 Monthly Mean run at JPL Surface Skin Temperature (K) and Total Precipitable Water (cm)



Version-6.4.6 AIRS/AMSU and AIRS Only monthly mean surface skin temperatures and total precipitable water agree well with each other.



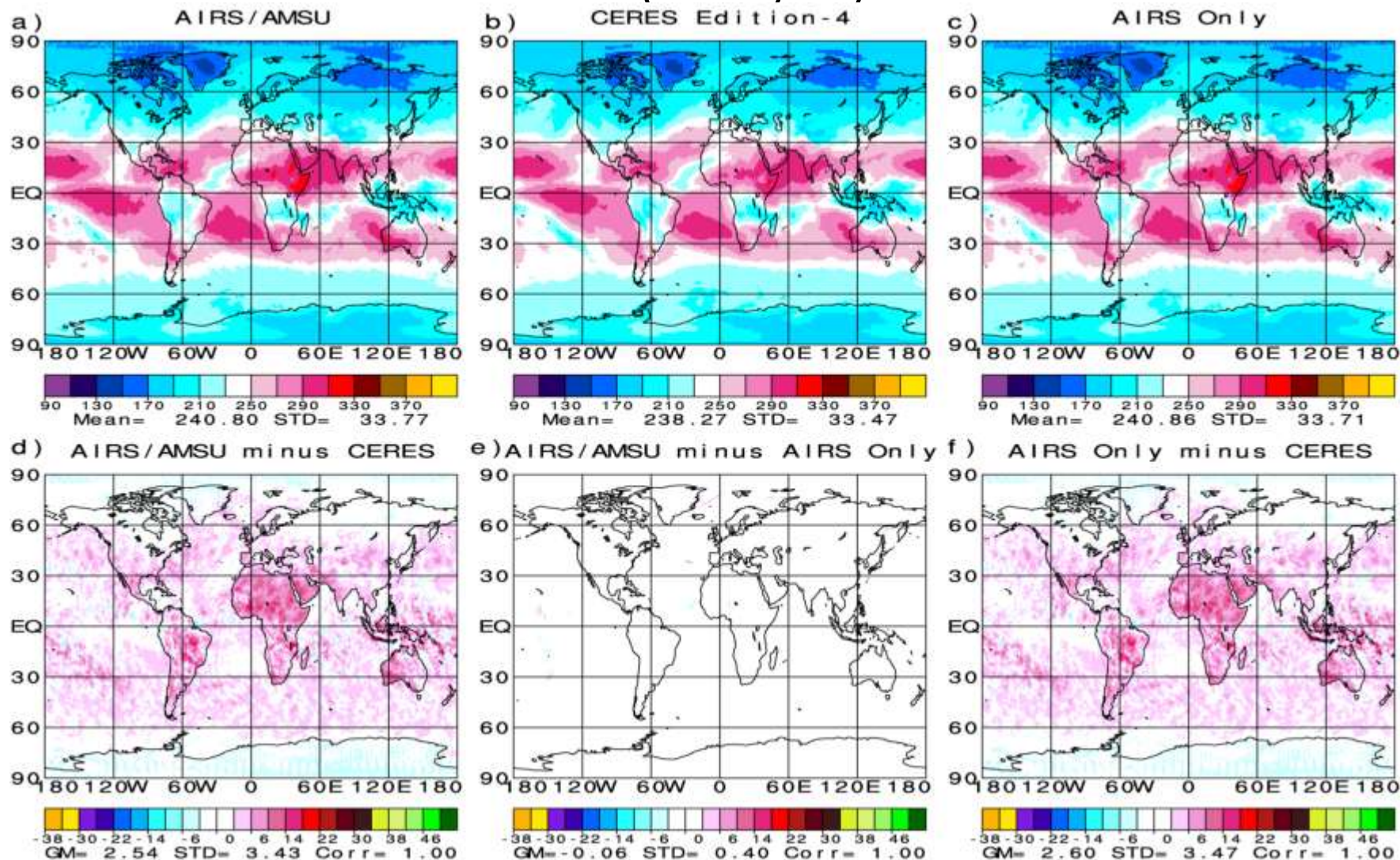
# January 2015 Version-6.4.6 Monthly Mean run at JPL 500 mb Temperature (K) and 300 mb Temperature (K)



Monthly mean Version-6.4.6 AIRS/AMSU and AIRS Only 500 mb and 300 mb temperatures agree extremely well with each other.



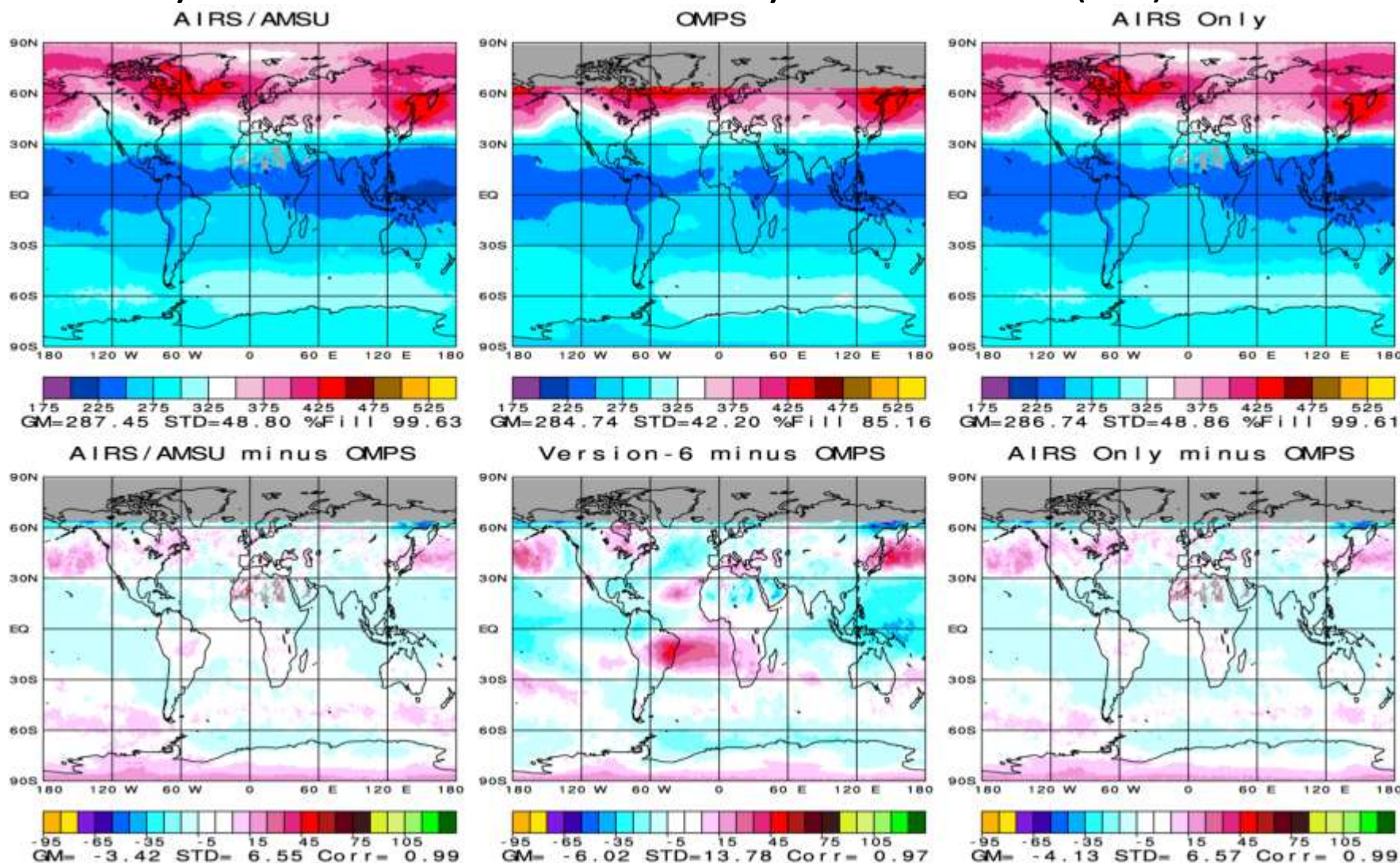
# January 2015 Version-6.4.6 Monthly Mean run at JPL OLR (Watts/m<sup>2</sup>)



Version-6.4.6 AIRS/AMSU and Version-6.4.6 AIRS Only OLR agree extremely well with each other and agree well with CERES.

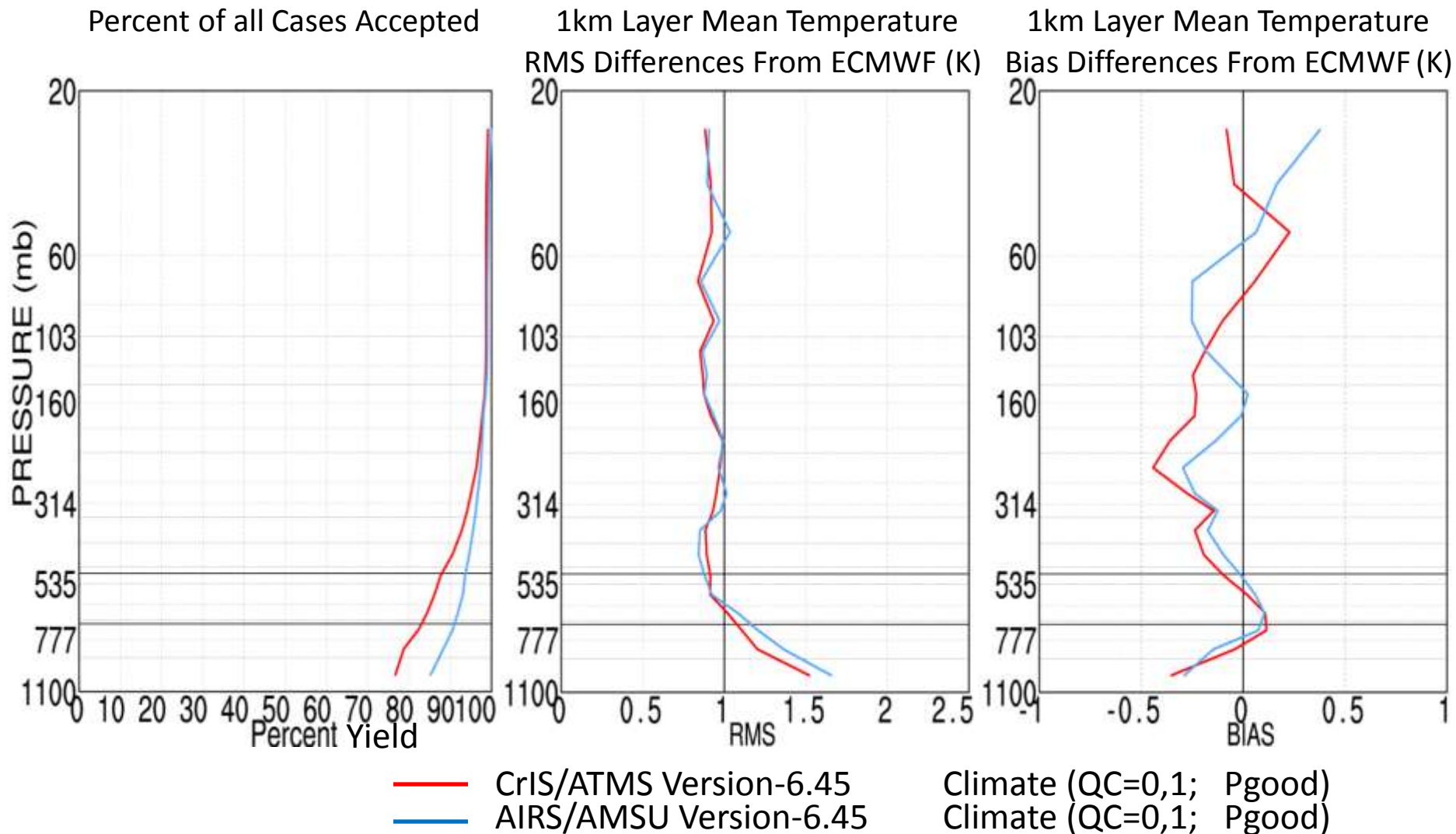


# January 2015 Version-6.4.6 Monthly Mean Ozone (DU) run at JPL



Version-6.4.6 AIRS/AMSU and Version-6.4.6. AIRS Only total ozone agree extremely well with each other and with OMPS. Version-6.4.6 AO total  $O_3$  is significantly better than Version-6. The major improvement in total  $O_3$  is the biggest reason for production of Version-7 to start in the near future.

# April 15, 2016 Global



CrIS/ATMS Version-6.45 temperature profiles passing climate QC are of comparable accuracy to those of AIRS. We don't have this result for Version-6.46. The differences between 6.46 and 6.45 would not affect accuracies.



# April 15, 2016 Global

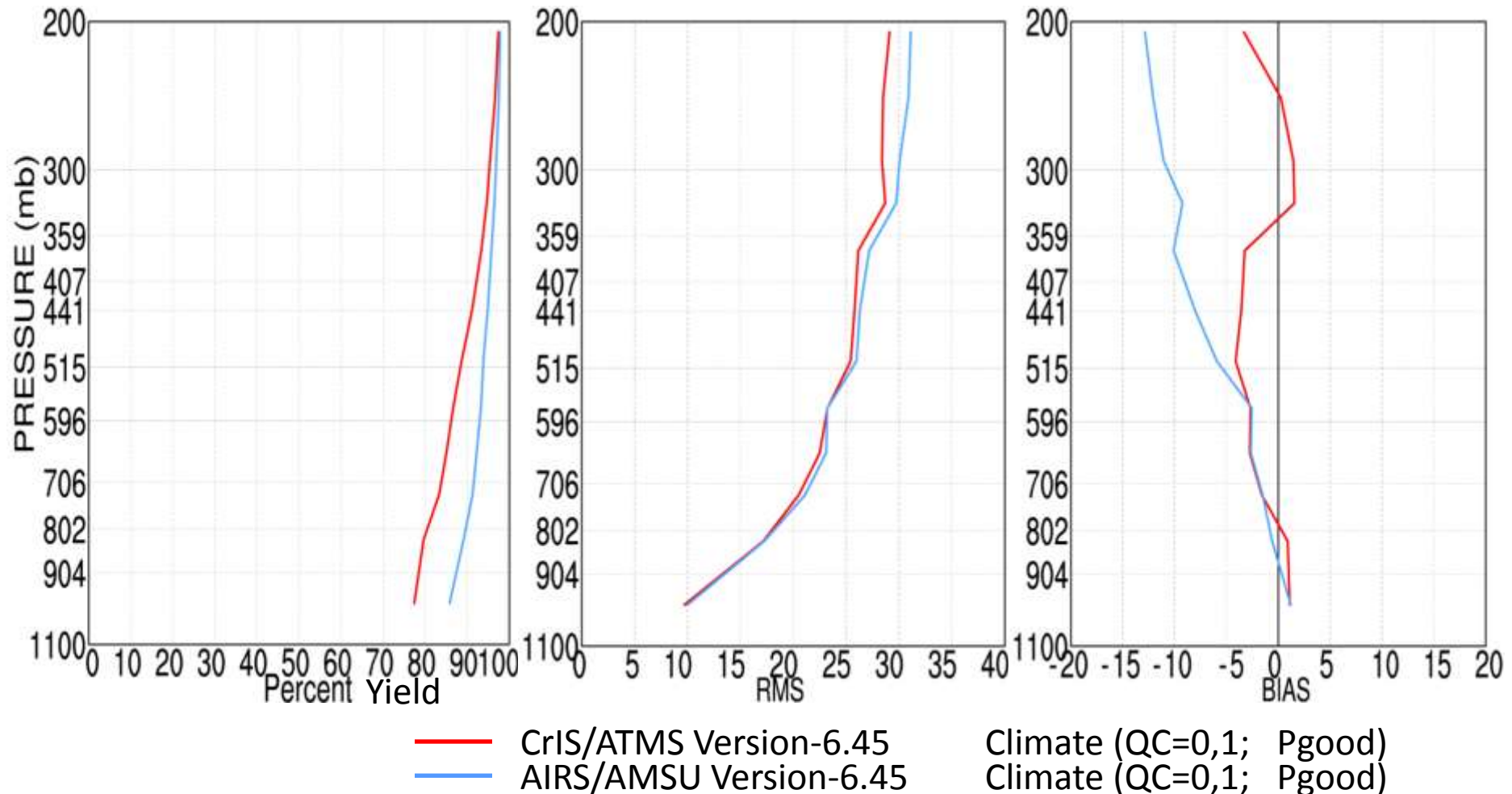
Percent of all Cases Accepted

1km Layer Precipitable Water

1km Layer Precipitable Water

RMS % Differences From ECMWF

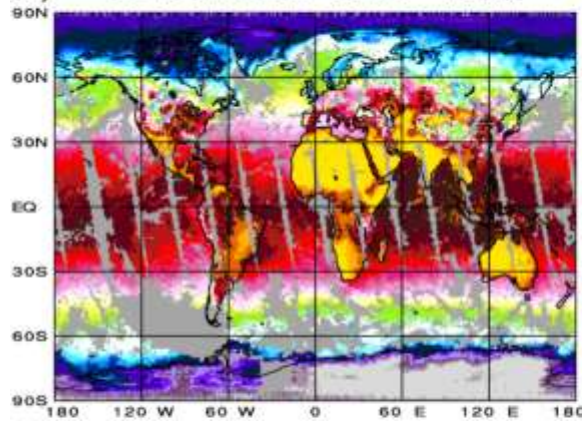
Bias % Differences From ECMWF



Version-6.45 CrIS/ATMS water vapor profiles are actually more accurate than those of AIRS/AMSU and do not show a dry upper tropospheric bias.

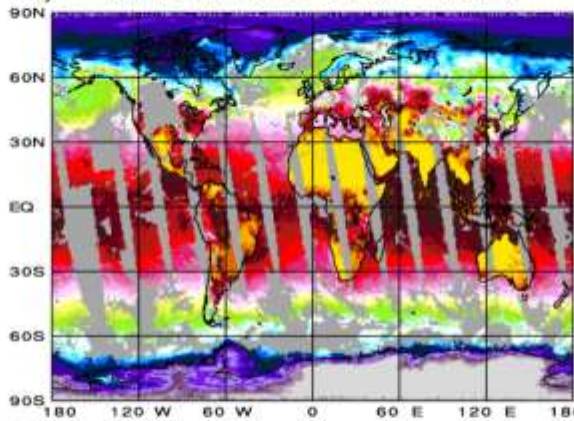
April 15, 2016 1:30 PM  
Surface Skin Temperature (K) and  
Total Precipitable Water (cm)

a) CrIS/ATMS Surf Temp



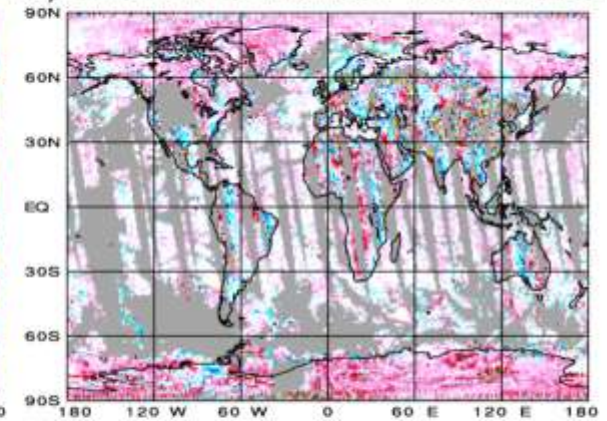
224 244 261 269 277 285 293 301 315  
GM=292.15 STD=15.33 %Fill 76.27

b) AIRS/AMSU Surf Temp



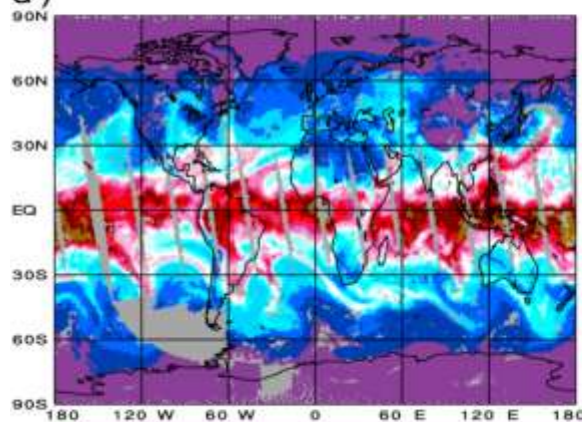
224 244 261 269 277 285 293 301 315  
GM=290.26 STD=16.31 %Fill 72.60

c) CrIS/ATMS minus AIRS/AMSU



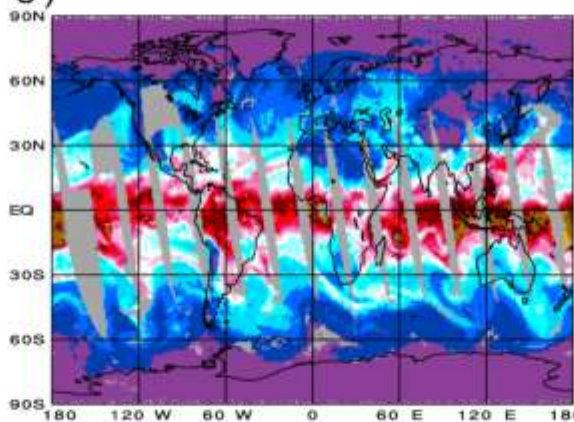
-9.50 -5.50 -1.50 1.50 5.50 9.50  
GM= 0.24 STD= 2.65 Corr= 1.00

d) CrIS/ATMS Total PPT



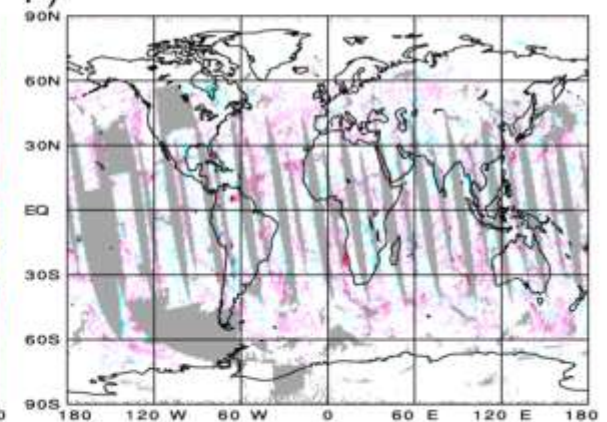
0 1 2 3 4 5 6 7  
GM=2.42 STD= 1.71 %Fill 87.98

e) AIRS/AMSU Total PPT



0 1 2 3 4 5 6 7  
GM=2.26 STD= 1.74 %Fill 84.00

f) CrIS/ATMS minus AIRS/AMSU



-1.90 -1.10 -0.30 0.30 1.10 1.90  
GM= 0.02 STD= 0.19 Corr= 1.00

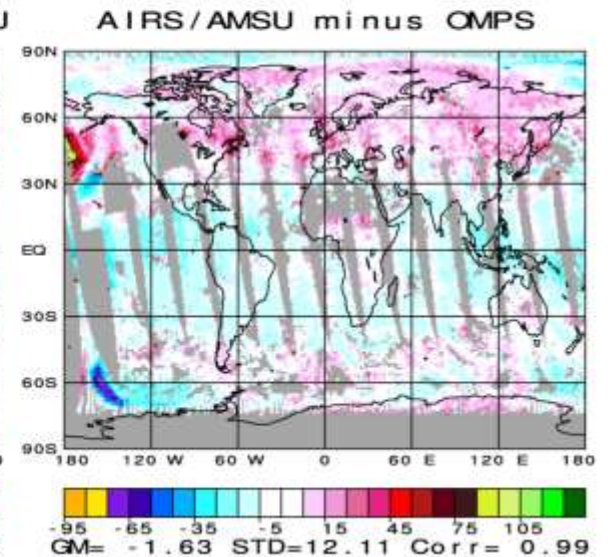
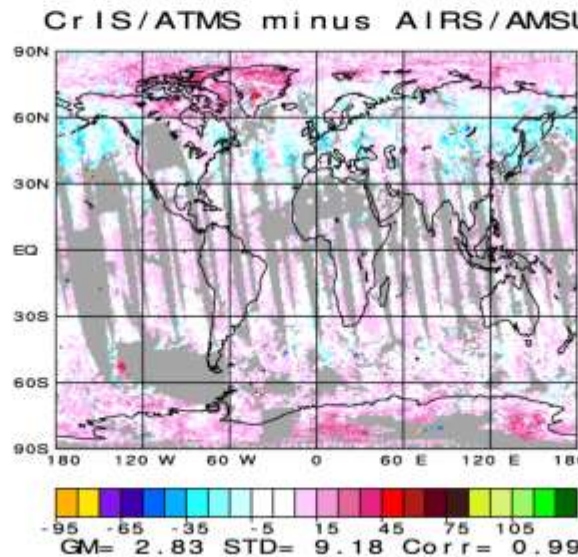
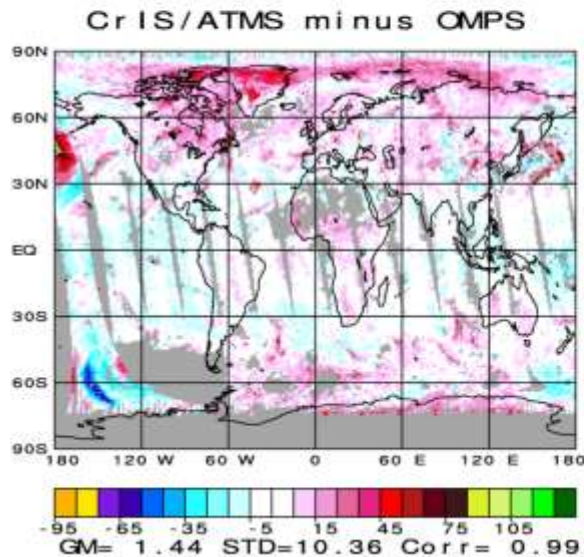
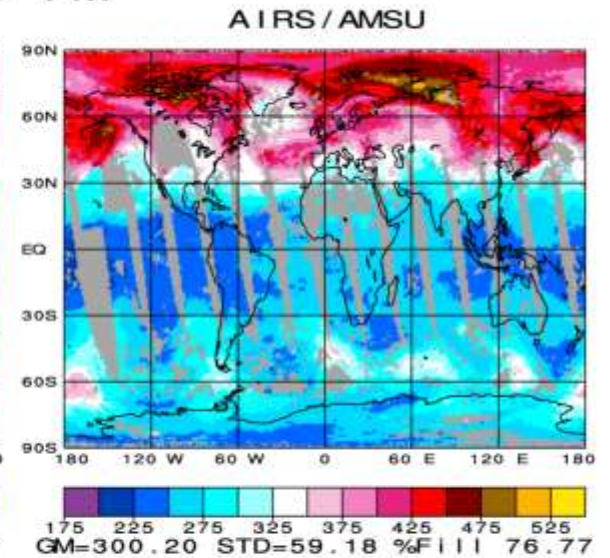
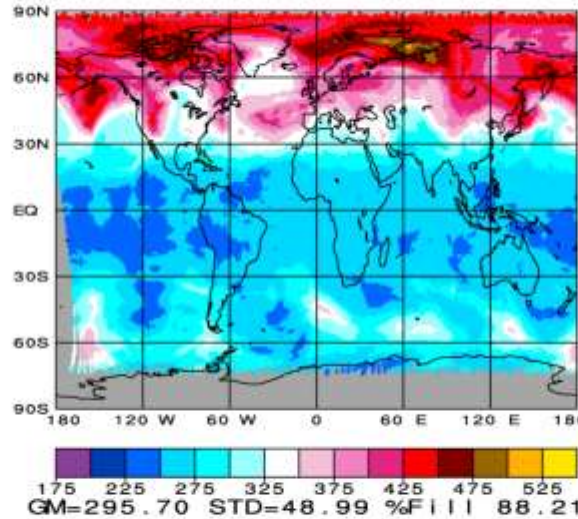
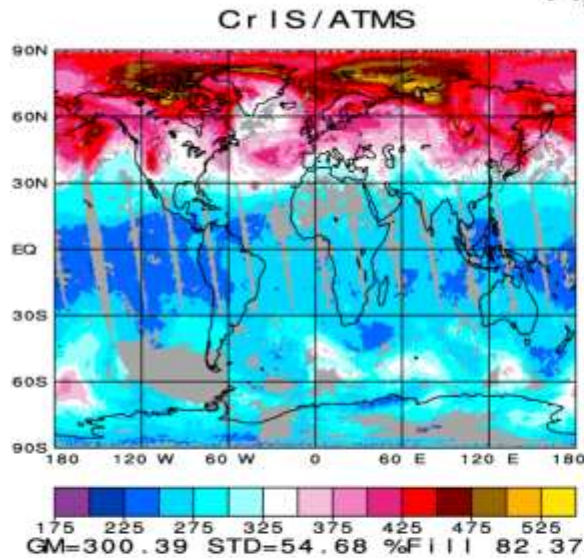
CrIS/ATMS surface skin temperatures agree very well with AIRS/AMSU over ocean, but have some differences with AIRS/AMSU over land, especially over the poles. Measurement times in a given location are not the same.







Ozone (DU)  
April 15, 2016 1:30 PM



CrIS/ATMS total ozone products match OMPS even better than do AIRS/AMSU.

# Scientific Findings and Recommendations

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- Version-6.46 temperature profiles, water vapor profiles, and especially total  $O_3$ , are very much improved compared to Version-6. With minor tweaking, Version-6.46 is a good candidate for use in Version-7.
- JPL Version-6.4.6 and Version-6.4.6 AO monthly mean products agree extremely well with each other. Version-6.4.6 AO is accurate enough that there is not necessarily a need to process both Version-7 and Version-7 AO data sets.
- Single day comparisons show Version-6.46 CrIS/ATMS and Version-6.46 AIRS/AMSU products agree extremely well with each other. We need to demonstrate agreement of Version-6.46 CrIS/ATMS and Version-6.46 AO products on a monthly mean basis for different months and years. CrIS/ATMS and AIRS/AMSU monthly mean comparisons showed excellent agreement using a previous version.